DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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November 7, 2003

The Honorable Jessie Hill Roberson
Assistant Secretary for Environmental Management
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Ms. Roberson:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the Transuranic (TRU) Waste Retrieval Project at the Hanford Site. This effort includes the retrieval of more than 38,000 containers of TRU waste from the Hanford burial grounds in preparation for processing, if necessary, and shipment to the Waste Isolation Pilot Plant. Several hazards are presented by the TRU waste, including high radiation levels that will require some containers to be handled remotely and the potential for the release of radioactive material from the containers. The Board's staff focused on these two hazards, in particular. The results of the staff's review are documented in the enclosed report.

The Board notes its continued concern with the 12 drums that contain significant quantities of plutonium-238. The Board identified the need for a disposition path for these drums in a letter dated June 11, 2002; however, specific information regarding the retrieval, handling and disposition of these drums still is not available.

Therefore, pursuant to 42 U.S.C. § 2286b(d), the Board requests that the Department of Energy provide a written response within 90 days of receipt of this letter that describes specific actions planned to:

(1) Safely retrieve and handle these 12 drums;

(2) Verify the integrity of the drums soon after retrieval and take corrective actions if needed;

(3) Establish a safe storage condition for these drums pending final disposition; and

(4) Appropriately repackage and disposition the drums.

These actions could also be applicable to other unique drums encountered during the TRU retrieval operation.

Sincerely,

John T. Conway
Chairman

c: Mr. Keith A. Klein
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

October 13, 2003

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: D. Ogg

SUBJECT: Transuranic Waste Retrieval, Hanford Site

The staff of the Defense Nuclear Facilities Safety Board (Board) reviewed the plans of the Department of Energy (DOE) and its contractor to retrieve buried transuranic (TRU) waste at the Hanford Site. Staff members D. Ogg and D. Winters visited the Hanford Site during August 27–28, 2003, joined by D. Grover, Hanford Site Representative. The staff also participated in teleconferences with site personnel on September 10 and September 17, 2003.

Background. The Hanford Solid Waste Operations Complex includes eight burial grounds covering approximately 1,400 acres, and contains low-level waste, mixed low-level waste, remote-handled TRU waste, and contact-handled TRU waste. Between 1970 and the late 1980s, DOE placed TRU waste drums into retrievable storage in five of these eight burial grounds. From 1998 to 2001, DOE and its contractor removed more than 1,400 drums of TRU waste (only those drums not covered with soil) from trenches in some of the burial grounds. However, more than 38,000 drums and boxes of TRU waste remain covered with soil in retrievable storage.

DOE and its contractor now plan to retrieve contact-handled TRU waste that is covered with soil. This new project, called the TRU Waste Retrieval Project, includes the removal of drums and boxes from seven trenches in two burial grounds (281-W-4B and 281-W-4C) that contain about 90 percent by mass of the remaining TRU waste. Remote-handled TRU may be moved during this activity but will not be processed until a new remote-handling facility becomes available.

Plutonium-238 Drums. Trench 1 in burial ground 4C contains 12 unique drums that were retrievably stored in 1977. These 12 drums contain packaged plutonium oxide with a high plutonium-238 (Pu-238) content. The plutonium loading in these drums ranges from approximately 200 to 500 grams per drum, about 18 percent being Pu-238.

These drums pose greater hazards than the typical drum to be handled as part of the TRU retrieval program. The high specific activity of the alpha-particle-emitting Pu-238 causes the packaged material and drums to be thermally hot: a thermal analysis performed prior to placement of the drums in the trench estimated that the centerline temperatures in the storage containers would reach 682°F. Also, the isotopic composition of the material would pose an

internal radiation exposure hazard considerably in excess of weapons grade plutonium in the event of an intake.

The control for this hazard relies on the integrity of the layers of packaging. The plutonium oxide was packaged in a robust system which includes two sealed aluminum containers inside a metal-gasketed stainless steel container, all inside a 55-gallon drum. However, the lengthy storage period under higher than normal heat and radiation fields raises concerns about the condition of the containers. DOE has reported experience at the Savannah River Site showing aluminum containers under similar conditions often spall and lose their integrity. The potential for deterioration of these packages does not support extended delay in dispositioning this high hazard material.

The Board raised concerns with these 12 drums in a letter to DOE dated June 11, 2002. The Board pointed out that there was a need for a final disposition path, a hazards analysis to support development of safe retrieval and handling procedures, and an available and appropriate facility to handle and repackage these drums. Earlier this year, the Board's staff again raised these concerns, and the DOE Richland Operation Office (DOE-RL) issued a Technical Assistance Request asking for support from experts in the DOE complex in defining an appropriate path forward. However, DOE-RL informed the staff during this site visit that the request was denied.

The contractor currently intends to proceed with the TRU waste retrieval activities without a firm plan for Pu-238 drums. It appears that the tentative plan is to set the Pu-238 drums aside after they have been retrieved and to store them above ground until a disposition path is developed. However, many of the hot cells and shielded gloveboxes at Hanford have been deactivated or are planned for deactivation soon, and a new facility for remote-handled waste will likely not be available until after 2015. This could result in keeping the drums in interim storage for an additional decade or more after retrieval.

The Board's staff believes it would be prudent for DOE to carefully plan for the safe retrieval and handling of these drums in the near future, to verify the integrity of the drums soon after they are retrieved, to establish a safe storage condition for the drums while awaiting disposition, and to carefully consider options for the repackaging and disposition of the drums.

Accident Analyses. The staff reviewed the Master Documented Safety Analysis (MDSA) for the Solid Waste Operations Complex, which includes the Low-Level Burial Grounds. One design basis accident of particular interest is the single-drum deflagration accident. Contractor analysts determined that the unmitigated consequence for a collocated worker in this postulated accident is a dose of 260 rem (off-site consequences are well below evaluation guidelines). Since this evaluated dose is considered significant, the DOE Standard *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, DOE-STD-3009-94, Change Notice 2, suggests that safety-significant controls be developed and implemented to mitigate the hazard. Guidance from the DOE-RL manager to the contractor on the functional classification of safety controls requires this level of control.

For this accident, contractor analysts proposed a safety-significant administrative control for venting waste containers, a safety-significant Drum Venting System, and several other administrative control programs.

After the contractor submitted the MDSA to DOE, DOE issued its Safety Evaluation Report and noted that additional controls were necessary for the single-drum deflagration accident. DOE added a time limit for staging unvented containers, as follows:

> During TRU Retrieval operations, un-vented TRU, suspect TRU, and other waste containers requiring venting SHALL be accumulated in batches. Once more than 50 containers are accumulated in a batch, a 90-day clock SHALL be initiated. All drums within the batch SHALL be vented in accordance with TSR-AC 5.6.1 within the 90-day time period. The total number of un-vented containers not on a 90-day clock SHALL not exceed 50. Backlogged un-vented containers previously identified in the LLBG [Low Level Burial Grounds] SHALL be vented within 120 days of the drum venting system being declared operational. A QUARTERLY SURVEILLANCE SHALL be performed to assure containers requiring venting are segregated AND accumulated batches of 50 or more containers are within the 90-day clock.

The contractor then added this requirement to the Container Management program in the Administrative Control section of the Technical Safety Requirements (TSRs), and DOE-RL approved the MDSA and TSRs.

The staff did not agree that the control set for the single-drum deflagration accident was adequate for several reasons:

- The mitigated frequency of the drum deflagration accident drops to the unlikely range, but the consequences to the worker remain high (i.e., 260 rem). Thus the accident presents a risk that warranted further control, but no additional controls were offered.

- The administrative control dictated by DOE applies to batches of more than 50 drums. If work is delayed or stopped with fewer than 50 drums accumulated, there are no time limits for venting the drums.

- DOE-RL did not provide justification for why 90 days is an acceptable period of time to allow a drum to remain unvented after it has been handled and moved.

- The control dictated by DOE has all the features of a Limiting Condition for Operation (LCO). More formality would be gained by designating it as an LCO in the TSRs (after addressing the issues noted above).

The staff's comments were transmitted to site personnel and discussed during two teleconferences in September. As a result of these discussions, DOE-RL decided to make some changes in the controls, including the following:

- Unvented drums that may generate oxygen or that are bulged shall be overpacked and then vented within 5 days.

- Unvented drums that contain more than 6.6 curies (Pu-equivalent) shall be overpacked.

- Drums containing more than 2 grams (Pu-equivalent) shall be accumulated in batches.

- No more than 24 drums shall be accumulated in a batch. A batch shall be considered complete upon receipt of the twenty-fourth drum. Only one partial batch shall be accumulating during retrieval activities at a given time. The number of unvented containers (i.e., sum of complete and partial batches) requiring venting shall not exceed 192.

- All drums within the batch shall be vented within 30 days of the date on which the batch receives the twenty-fourth drum.

- A monthly surveillance shall be performed to ensure that drums requiring venting are segregated, and each accumulated batch is within the 30-day clock.

The Board's staff views this set of TSRs as an improvement over the previous set, and believes that the new TSRs provide some additional conservatism. However, the staff remains concerned that no limit exists to prevent having as many as 23 drums exposed and unvented for an indefinite period of time. In addition, the details of how the controls will be procedurally implemented were not available for review. The staff plans additional discussions with the site to cover these topics.